CHAPTER 3 - ALTERNATIVES

3.1 INTRODUCTION

As discussed in Chapter 1, King County has committed to control annual CSO volumes discharged to Elliott Bay at the Denny Way Regulator Station and to control the frequency and volume of discharge to Lake Union from the Dexter CSO. Seattle has committed to control annual frequency of discharge into Lake Union to one untreated overflow per outfall per year by the end of 2005. King County and Seattle developed alternatives to meet these levels of control. Phase 1 of the Denny/Lake Union Project was recently constructed by Seattle. This chapter describes alternatives development, the No Action Alternative, and the CSO control alternatives being evaluated in this final joint document for Phases 2, Seattle's connection from Phase 1 to King County's system, and the combined Phase 3/4, King County's new CSO control facilities.

A description of general control options for CSOs is included in Section 3.2. To assist the decisionmakers and readers, a general description of CSO facilities are included in Appendix C and general construction methods are included in Appendix D. Section 3.3 describes the alternative development and screening process. Section 3.4 discusses several alternatives considered and eliminated during the alternative development process and the reasons for dropping them from further analysis. Section 3.5 covers wastewater issues that Federal grantees are required to consider. Three alternatives, including the No Action Alternative, were selected for further analysis and are described in Section 3.6. A comparative evaluation of the environmental impacts of the two selected alternatives is included in Section 3.7.

Alignments and locations for new facilities shown in this final joint document are considered to be representative locations. The alternatives are in the predesign phase, therefore, the details are only conceptually defined at this time. Final alignments and locations will be developed during final design. If the final locations differ from those considered in this final joint document, EPA, King County and Seattle will evaluate the potential environmental impacts to determine if these alignments or locations will result in environmental impacts that are outside the range of impacts and alternatives considered in this final joint document. As appropriate, additional environmental documents, such as addenda, may be prepared to address impacts not considered in the final joint document.

3.2 GENERAL CSO CONTROL APPROACHES

Given the constraints of existing major facilities (e.g., size of EBI, capacity of the West Point Treatment Plant), there are four general approaches to controlling CSOs at the Denny Way and Dexter regulator stations and into Lake Union. These four general approaches are not mutually exclusive. By combining varying degrees of separation, storage, conveyance, and treatment, numerous solutions to the overflow problem are possible. Sizing and location of CSO facilities is a complex process requiring review of a series of alternatives before arriving at the optimal configuration. The storage or

treatment volume required to meet a given CSO control level is based on flow rates, total volume of CSOs, storage/treatment times, conveyance facilities, and other specific requirements. Storage and subsequent secondary treatment, primary treatment, at-site treatment, and storm sewer separation represent, in the order listed, decreasing levels of pollutant removal.

Separation

Separation is the conversion of a combined sewer system into separate stormwater and wastewater collection systems by installing new pipelines and regulator stations to convey either stormwater or wastewater flows. Stormwater is discharged directly to local waterbodies. Total separation intercepts both street and private property drainage. Partial separation involves installation of pipelines to intercept street runoff and as much private property stormwater as feasible. Flow volumes are reduced by removing the stormwater flows, thus requiring smaller conveyance, storage and treatment facilities for the remaining sewage.

Storage

Storage facilities hold peak combined sewage flows during storms until capacity becomes available in the conveyance system and treatment plant. Aboveground or belowground storage tanks, underground pipes and tunnels are the types of facilities that provide storage. Pumps, regulators, and solids collection are often required. Odor control and washdown systems may also be necessary. Based on the length of time the water is within the storage unit, these facilities can provide some solids and floatables removal.

CSO Control with Primary Treatment at Existing Facilities

Combined wastewater is transported to existing treatment facilities that have sufficient capacity to treat excess flows. Ecology requires that CSOs be given solids removal and disinfection before discharge). Since existing primary treatment capacity is not available for all storms, the conveyance system would be sized to allow flows to back-up into the system without causing overflows upstream of the treatment plant. Once the storm subsides and treatment capacity becomes available, the flows are released to the plant for treatment.

CSO Control at New At-site Facility

At-site treatment of CSO flows involves technologies such as primary sedimentation tanks, vortex separators, baffled tanks, and/or screens near the CSO outfall to regulate flow and separate solids. Vortex separators are cylindrical vessels that induce solid separation through a swirling motion where solids are concentrated and removed through an underdrain, while clarified effluent passes over a weir at the top of the vessel. Sediment enhancements such as chemical addition or dissolved air flow (DAF) could also be used to assist in solids removal. Effluent may be disinfected and/or dechlorinated prior to discharge into a waterbody through an outfall.

3.3 ALTERNATIVES DEVELOPMENT AND SCREENING

This section provides a brief overview of alternatives development. The draft Phases 2, and 3/4 facilities plan alternatives (King County and City of Seattle 1997) provides a detailed discussion of the development and screening process for.

As presented in Section 1.4, the project objective is to preserve long-term water quality by implementing CSO control as quickly, efficiently and cost-effectively as possible, consistent with King County's and Seattle's statutory and contractual responsibilities. The project is intended to comply with current state and federal requirements to reduce CSOs.

In 1993 and 1994, agency workshops were held to develop criteria for selection of CSO control alternatives, to review general system-wide CSO conditions, to receive input on general control methods to be examined, and to review and evaluate the Denny Basin CSO control alternatives developed by the consultant team. The following criteria were used by the project team to evaluate the Denny alternatives (most important to least important): health and safety impacts, impacts on natural environment, reliability and operability, economic impacts, flexibility, impacts on social environment, and fairness and equity. General CSO control methods were ranked by the participants for major portions of the system. For Denny, the participants indicated a preference for system-wide optimization to link Denny controls with the remainder of the wastewater system.

Following the workshop evaluations, agency staff selected a preferred alternative with a combination of elements to provide the most flexibility in operations and to be adaptable to all system-wide CSO control solutions selected as a result of future Regional Wastewater Services Plan (RWSP) decisions. Alternatives that were infeasible or did not meet project objectives were eliminated and specific alternatives for further evaluation were selected.

During 1995 and 1996, King County and consultants refined the preferred alternative to meet regulatory requirements and future RWSP decisions by looking at various options and sizes for each component. In 1996, Ecology and King County reviewed the refinement process and additional engineering studies in conjunction with the regulatory requirements for the reduction of CSOs.

3.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER CONSIDERATION

WAC 197-11-786 describes a "reasonable alternative" as any action that feasibly "attains or approximates a proposal's objectives, but at a lower environmental cost or decreased level of environmental degradation."

Numerous alternative CSO control methods have been considered over the course of this evaluation. Some have been eliminated from further consideration because of overriding concerns about neighborhood or environmental impacts, costs or other factors. Following is a brief description of the alternatives removed from further consideration, as well as a discussion of why each was eliminated.

3.4.1 Alternatives Eliminated for CSO 175

Within the overall selection of improved transport of flows, two other locations were considered for crossing Interstate 5. A crossing through an existing sewer pipe corridor, using pipe bursting, at Belmont Avenue East was rejected because of the potential for damaging Interstate 5 pavement and disrupting traffic during construction at two retaining walls. A crossing by hanging a pipe on the overpass structure was eliminated because elevation differences make it infeasible.

Two methods of crossing at East Prospect Street were examined. Open-cut pipe installation was rejected because of the high level of disruption and Washington State Department of Transportation policy prohibiting open-cut crossings. A small-diameter tunnel crossing was rejected because of the high risk of immobilizing a boring machine. During construction of Interstate 5, large quantities of rock backfill were used and there are no location records. In addition, piling supports of the retaining walls create a barrier at East Prospect Street.

A storage tank alternative, originally proposed in a 1992 Design Memorandum prepared for Ecology, was later eliminated because it would require closure of Lakeview Boulevard for several months.

The *Final NEPA Environmental Assessment, Phase 1* (Seattle 1995a) evaluated the impacts of partial separation, total separation and a combination of partial separation and storage for the CSO #175 area as part of alternatives for the entire East Lake Union Basin. All three alternatives were eliminated due to negative water quality impacts from increased stormwater flow discharged to Lake Union, much greater construction impacts from pipeline construction, and cost.

3.4.2 Alternatives Eliminated for CSO Control

Many alternatives for control of CSOs in the project area were analyzed during pre-design. The following alternatives were eliminated from further consideration.

Storage Only Alternative. Under this alternative, sufficient storage volume would be provided so that annual untreated CSO discharge at the Denny Regulator would be reduced by 50 percent or to one event per year. Stored flows would be transferred to the West Point plant after the storm subsides. This alternative would require a 4.6 MG storage tank located on Elliott Avenue near Mercer Street and a 10.8 MG storage tank in the South Lake Union area or a much larger tunnel or two smaller tunnels. Conveyance facilities between the storage tanks or tunnels, existing Lake Union Tunnel, and Elliott Bay would be required as well as regulator stations and pump stations for each tank. A storage only alternative was considered and included in the SEPA Scoping Document (issued June 1995). This alternative offers no advantages over the Preferred Alternative. The size of both storage tanks would require major property and easement acquisition and would cause considerable neighborhood impacts during construction. Although the storage only alternative would meet the criteria of 50 percent reduction of CSOs at the Denny Way Regulator Station and flexibility to add future control, it does so at higher environmental and economic costs. Therefore, this alternative was dropped from further consideration.

Interbay Alternative. This alternative would include a new conveyance line to the Interbay Pump Station, a new siphon under the Ship Canal, a tunnel and open-cut sewer to convey and store flows

from the Denny Way Regulator Station and South Lake Union, and storage at the Denny Way Regulator Station for flows which cannot be diverted into the new conveyance to the Interbay site. The Interbay alternative offers certain advantages including the ability to control Denny, Ballard and Third Avenue West flows and the potential to be used as a regulator to control flows into West Point. However, it suffers the disadvantages of greater costs (because of the increased conveyance needs to bring flows to the facility), difficulty in land acquisition, and potential land use conflicts. As a result, the workshop participants recommended dropping the Interbay alternative from further consideration.

Total Separation Alternative. The option of building a new wastewater network and utilizing the existing combined sewer as a storm drain would provide 50 percent reduction of overflows at the Denny Regulator. This option was not developed in detail because of the legal and construction difficulties associated with on-site private property separation that is required for total separation. However, partial separation was selected as an alternative to evaluate in this final joint document.

Alternative Sites for CSO Control Facility. In the early stages of the project, a search of vacant lots or lots for sale was completed at the west end of the proposed Mercer Street Tunnel. The search was completed along Elliott Avenue West from Broad Street north to the Interbay area. Only two available sites were identified with dimensions to fit a CSO control facility: the old Blackstock Lumber site and the old Captain's Table site. Further research of both sites with a potential site plan showed that only the Blackstock site would allow for future expansion, if necessary. Therefore, Metro bought the Blackstock site in 1994 and changed the name to the Elliott West site.

Alternative Tunnel Alignments. Besides the proposed Mercer-Roy Street alignment, two other alternative alignments were analyzed: West Olympic Place-Valley Street and Mercer Street. The Olympic Place-Valley Street alternative would impact Kinnear Park at the west end and would require boring under a privately-owned structure, the Bayview Manor Retirement Home. The Mercer alignment would have adverse effects on traffic flow due to the east portal location in a major arterial with heavy traffic volumes. The Mercer-Roy Street alignment was selected as the best tunnel alignment because it avoids construction under private property and minimizes traffic impacts during construction. In addition, cost estimates indicate that the proposed Mercer-Roy Street alignment would cost about 18 percent less than either of the other two alternatives.

3.4.3 Alternatives Considered in Value Engineering Study

In September, 1997, King County held a Value Engineering (VE) workshop to evaluate the conceptual alternatives for the Denny/Lake Union Project. The purpose of the VE workshop was to review the conceptual alternatives for CSO control and evaluate these concepts in terms of their technical feasibility/effectiveness and cost efficiency. The VE team, comprised of local and national experts in CSO management, recommended several modifications to the existing conceptual design based upon anticipated overall cost savings. After the VE team presented its recommendations, task force groups from the design teams and County staff were formed to provide a more detailed evaluation and a response to each proposal or recommendation.

After evaluation of the VE recommendations, King County decided to include only one change to the Preferred Alternative: the proposal to address future modification of the Dexter Regulator Station to divert additional flows into the Mercer Street Tunnel. This change would allow future modifications to

reduce overflows at Dexter and Third Avenue West, reduce the potential of flooded basements, result in future cost savings, and would have no negative environmental impacts.

Following is a summary of the major recommendations made by the VE team, and the subsequent evaluations and recommendations by the design team and King County.

Construct the Central Trunk Diversion Structure as a Regulator Structure. The VE team recommendation involves modifying the Dexter Regulator Station to allow diversion of approximately 30 mgd flow to the Mercer Street Tunnel, which would result in reduced on-site storage requirements at the future Third Avenue West CSO Control Project. Associated modifications would include adding a gate at the Central Trunk Regulator Station, modifications to the Dexter Regulator Station controls/weir, additional 30 mgd pumping capacity at the Elliott West CSO Control Facility, increasing the size of the effluent pipe, and modifications to the Elliott West pump station. The task force concluded that it would be appropriate to modify the Dexter Regulator Station for diversion to the future Mercer Street Tunnel as part of the Third Avenue West Project. Because all proposed modifications are internal to structures described in this final joint document, additional environmental review would not be required.

Locate the Elliott West Outfall Immediately Offshore from the Elliott West CSO Control Facility. The VE team recommended locating the Elliott West Outfall immediately offshore of the Elliott West site, rather than at the proposed location at the Denny Way Regulator Station. This alternative would eliminate the need for the 84-inch Elliott West Effluent Pipeline adjacent to Myrtle Edwards Park. The outfall would discharge at a location where predominant currents would be away from the tribal net pens. However, because of restrictions caused by the grain terminal and associated shipping requirements, the outfall length and discharge depth would be less than the proposed 60-foot depth at the Denny Way Regulator Station location. As a result, the expected dilution rate would be lower (approximately 5-6 to 1), compared with dilutions at the proposed location (approximately 9-10 to 1). The task force recommended against implementation of this alternative because of minimal cost savings and anticipated schedule delays associated with additional oceanographic and biological studies and additional environmental documentation. Additionally, location of the outfall in closer proximity to the tribal net pens could be a significant issue with the tribes, possibly requiring a lengthy process to relocate the net pens elsewhere in Elliott Bay.

Connect the Denny Way Diversion Structure to the Mercer Street Tunnel With a Tunnel Under Second Avenue West, Rather Than Constructing the Elliott West CSO Pipeline Adjacent to Myrtle Edwards Park. The VE team recommendation is associated with the proposal to relocate the Elliott West Outfall. The proposal is to construct the Elliott West CSO Pipeline by tunneling along Second Avenue West between the Denny Way Diversion Structure and the Mercer Street Tunnel, eliminating the need for shoreline pipelines adjacent to Myrtle Edwards Park. Two diversion structures, located south of the P-I building in the Denny Way right-of-way, would intercept flow from the Lake Union Tunnel and the Denny Local sewer. The task force recommended that this alternative be investigated further if the Elliott West Outfall is relocated to the grain terminal area, as described above. Additional SEPA/NEPA documentation would be required.

Realign the Mercer Street Tunnel to Follow Broad Street/Denny Way and Locate the CSO Control Facility at the West End of Denny Way. The VE recommendation suggests locating the CSO control facility in the vicinity of the parking lot south of Myrtle Edwards Park, and re-routing the Mercer Street

Tunnel to the new CSO control facility site. The revised tunnel alignment would be about 2,200 feet shorter than the proposed Mercer Street Tunnel. As a result, the tunnel diameter would be 18 feet to provide adequate storage. The Elliott West Effluent Pipeline would not be needed. The Elliott West CSO Pipeline, Denny Way Diversion Structure, and EBI Control Structure would still be required. The CSO control facility would require a site of 1.5 to 2 acres. The task force did not recommend implementing this proposal because of potential conflicts with City of Seattle zoning, significant schedule delays associated with re-engineering and additional environmental studies, and minimal potential cost savings. Supplemental SEPA/NEPA documentation would be required prior to implementing this proposal.

Eliminate Disinfection of Flows From the Elliott West CSO Control Facility. The VE Team recommended evaluating whether disinfection of treated CSO flows should be eliminated. The advantages of this suggestion include elimination of potential chlorine-related risks to fish in the tribal net pens and other marine biota, and capital and operating cost savings. The task force recommended against implementing this suggestion because of potential permitting issues, possible schedule delays, and a King County policy commitment to meet water quality standards. Supplemental environmental documentation would be required prior to implementation.

Reliability Improvements. During the VE process, suggestions were made to evaluate options to improve operational reliability during worst-case conditions such as extreme rainfall events coupled with high tidal conditions and power outages. The task force is continuing to evaluate such options, which may include installing additional or larger emergency generators at the Elliott West pump station. Any modifications would be enclosed within the proposed structures at the site and would comply with all applicable regulations. Additional environmental evaluation would not be required.

3.5 FEDERAL REQUIREMENTS

Federal water quality regulations (40 CFR Part 6.506(b)(5)) require that grantees in the Wastewater Treatment Construction Grants Program consider in environmental analyses the following when relevant to the project. Those relevant to the Denny/Lake Union Project have been incorporated into the various alternatives.

1. Flow and waste reduction measures, including infiltration/inflow reduction and pretreatment requirements;
2. Appropriate water conservation measures;
3. Alternative locations, capacities, and construction phasing of facilities;
4. Alternative waste management techniques, including pretreatment, treatment and discharge, wastewater reuse, land application, and individual systems;
5. Alternative methods for management of sludge (i.e., biosolids);
6. Improving effluent quality through more efficient operation and maintenance;
7. Appropriate energy reduction measures; and
8. Multiple use including recreation, other open space, and environmental education.

The Denny/Lake Union Project will transfer collected floatables and sediments to the West Point Treatment Plant (# 5). The design of the Denny/Lake Union Project facilities will maximize operation and maintenance efficiency and reduce energy requirements (# 6 and # 7). Section 3.6 describes the

alternatives and operation and maintenance of the facilities. Chapter 10 contains mitigation measures for each alternative.

3.6 DESCRIPTION OF SELECTED ALTERNATIVES

Two CSO control alternatives plus the No Action Alternative are being evaluated in detail for this final joint document. Each control alternative would control overflows at the Denny Way and Dexter regulator stations and Seattle outfalls in south Lake Union to one untreated overflow event per outfall per year. Other alternatives that were evaluated, but eliminated from further consideration, are summarized in Section 3.4 above.

The two CSO control alternatives proposed for evaluation in this final joint document were selected based on the following objectives:

- Reduce Seattle and King County CSOs into south Lake Union to one untreated overflow per outfall per year;
- Reduce King County CSOs at the Denny Way Regulator Station to one untreated overflow per year;
- Minimize shoreline, beach and park impacts consistent with shoreline management regulations;
- Minimize impacts to residential and commercial neighborhoods, and transportation corridors;
- Meet project objectives at the lowest practicable costs.

The alternatives analyzed in this final joint document are based on the analysis conducted to date, which would be refined in 1998 and 1999 during final design. Facility and pipe sizes indicated in the alternative descriptions below are estimated and could change during design. Modifications made before the final will be included in the final SEPA SEIS/NEPA EA. Modifications made after the final joint document is issued would require a supplement or addendum if the proposed project changes substantially alter anticipated impacts.

Alternatives Analyzed In This Final Joint Document. Based on the objectives above and previous CSO project plans, Metro selected two CSO control alternatives. In the 1980's, sewer separation was selected as the alternative to reduce flows at the Denny Way Regulator Station in the 1985, 1986 and 1988 CSO plans. Therefore, sewer separation was selected as one of the alternatives for analysis. In order to reduce overflows to one untreated discharge per year, additional storage was added to sewer separation. Sewer separation disperses impacts over a wide area of users as new pipes are constructed in streets.

A second CSO control alternative was selected based on reducing the widespread impacts from sewer separation. This alternative would provide CSO treatment and storage to reduce overflows to one

untreated discharge per year. In comparison with sewer separation, this alternative concentrates impacts in certain areas (e.g., end of tunnel). A storage only alternative was considered, but as described in Section 3.4 above, it was eliminated as it is similar to, but more expensive than, CSO treatment and storage.

As required by NEPA, the third alternative is the No Action Alternative. This alternative would not require facilities construction or meet the agreements between Ecology and King County and Seattle. However, the analysis is provided for comparison with the two CSO control alternatives. The three alternatives are numbered and described as follows. Detailed descriptions of facilities, construction, and operation is located in Sections 3.6.1, 3.6.2, and 3.6.3.

Alternative 1 - CSO Storage and Treatment (the Preferred Alternative)
Alternative 2 - Partial Separation and Storage
Alternative 3 - No Action Alternative

CSO Treatment. Ecology has adopted a number of regulations pertaining to municipal waste discharges, including CSOs (WAC Chapter 173-245). The regulations require that CSOs be controlled "such that an average of one untreated discharge may occur per year." In addition, CSO treatment is defined as being the equivalent of primary treatment. Section 1.3 Project Need provides a complete discussion of the regulatory requirements for CSOs.

Outfalls. Alternative locations for the Elliott West Outfall were considered. Locations considered were 1) due west of the CSO control facility and just south of the Port of Seattle grain terminal, and 2) due west of the Denny Way Regulator Station at the existing Denny Way CSO. The second alternative provides a number of advantages including a discharge location farther from the tribal fish pens and farther offshore of Myrtle Edwards Park; avoidance of the grain terminal and the most active portion of the offshore ship anchorage area; and cost-effective incorporation of the new outfall into the shoreline transition structure required to extend the existing CSO outfall. In addition, the Elliott West Effluent Pipeline from the control facility to the new outfall could be installed in the same construction corridor as the Elliott West CSO Pipeline. This pipeline also provides chlorine contact time for disinfection, thus eliminating the need for a chlorine contact tank at the control facility. For these reasons, the Denny Way Regulator Station location is proposed for the Elliott West Outfall.

Alternative 1 requires two CSO outfalls into Elliott Bay, one for discharge of treated flows from the Elliott West CSO Control Facility and the second as an extension of the existing Denny outfall for discharge of untreated CSOs during the largest storms. The Elliott West Outfall would be pile supported. It would extend approximately 500 feet offshore (just past the Denny Way Sediment Cap) to 60 to 70 foot (21 to 22 meters) water depth. The Denny Way CSO Outfall Extension would also be pile supported and extend offshore approximately 100 feet to 10 to 20 foot water depth.

Sediment Remediation Offshore of Denny Way Regulator Station. King County is working with Ecology and the Washington Department of Natural Resources to develop a remediation plan as part of permit and right-of-way applications for the outfalls. The plan will establish current sediment quality, requirements for sediment monitoring, and a timeframe and preliminary plan for addressing remediation of existing sediment contamination.

3.6.1 Alternative 1 - CSO Storage and Treatment (the Preferred Alternative)

This section briefly describes Alternative 1 facilities. Appendix C includes a general description of each type of facility. Appendix D describes general construction methods. Appendix Q provides a detailed description of each facility including figures with proposed facility placement and landscaping. All facility sizes are approximated based on current design.

3.6.1.1 Facilities

Alternative 1, a storage and treatment option is illustrated in Figure 3-1 and consists of outfall improvements and modifications, conveyance facilities, control facilities, and regulators, pumps and other regulating structures. Tables 3-1 and 3-2 describe each facility by subbasin .

King County currently owns the Elliott West site located at 545 to 601 Elliott Avenue West. The three acre site is bounded by Burlington Northern/Santa Fe Railroad track to the southwest, commercial properties to the northwest and southeast, and Elliott Avenue West to the northeast. Property and easement acquisition requirements may include construction easements in the South Lake Union area.

Alternative 1, South Lake Union Subbasin Facilities (see Table 3-1). The facilities in the South Lake Union Subbasin connect CSOs from Seattle's Phase 1 project in east Lake Union, the existing Lake Union Tunnel and the existing Central Trunk to the new Mercer Street Tunnel for storage and conveyance to the Elliott West CSO Control Facility. The tunnel and control facility are in the Elliott Bay Subbasin although the East Tunnel Portal Drop Structure is included in the South Lake Union Subbasin. Trenchless technology construction methods for some pipelines in the South Lake Union area are recommended due to depth of pipe and a combination of poor soils, high groundwater, the presence of contaminated soils, high traffic volumes, and other impacts. However, based on design, some of the pipelines could be open-trench construction. Table 3-1 briefly describes the type and name of each facility for Alternative 1 in the South Lake Union Subbasin as well as the approximate size, location and purpose of facilities identified on Figure 3-1. Appendix Q describes each facility in more detail.

Alternative 1, Elliott Bay Subbasin (see Table 3-2). The facilities in the Elliott Bay Subbasin would convey and store flows from the South Lake Union Subbasin and the existing Lake Union Tunnel to the Elliott West CSO Control Facility. A connection to the EBI also would allow flows from the EBI to be stored and/or treated at the Elliott West CSO Control Facility or flows from the new Mercer Street Tunnel and existing Lake Union Tunnel to be pumped into the EBI for conveyance to and treatment at West Point. Table 3-2 briefly describes the type and name of each facility for Alternative 1 in the South Lake Union Subbasin as well as the approximate size, location and purpose of facilities identified on Figure 3-1. Appendix Q describes each facility in more detail.

3.6.1.2 Construction

The new Mercer Street Tunnel is expected to be mined from west (Elliott Avenue West) to east (south Lake Union) using a tunnel boring machine. The West Tunnel Portal would be located on the west side Elliott Avenue West on the Elliott West site. The tunnel would lie under the Mercer Street right-of-way to Broad Street, then angle northeast to the East Tunnel Portal Drop Structure at Eighth Avenue

North and Roy Street. This alignment would avoid interference with the proposed Broad Street underpass or future Mercer Street improvements. Other conveyance pipelines would primarily be constructed by open-cut trenching (see Appendix D). The Elliott West CSO Pipeline and Elliott West Effluent Pipeline would be constructed outside the fenceline of the Cargill Grain Terminal rail yard but within Elliott Bay Park and Alaskan Way right-of-way. No construction would occur on Myrtle Edwards Park property but within existing street and utility rights-of-way. Table 3-3 presents by subbasin the construction durations estimated for Alternative 1 facilities.

3.6.1.3 Operation and Performance

The final system would have several modes of operation determined by the quantity of wastewater entering the system, the tidal elevation, and the upstream and downstream conditions (Endersly 1996a). The weir elevations and gate positions would be set so that dry weather flows are not influenced. It is estimated that approximately 33 events per year would be stored in the tunnel and treated at West Point and about 8 to 20 events per year would need treatment at the Elliott West CSO Control Facility.

Combined wastewater would flow through the existing 60- to 72-inch diameter Lake Union Tunnel until the capacity of the tunnel is reached. At that point, flows would be directed to the new Mercer Street Tunnel for storage. Meanwhile, excess flows up to 70 mgd would be pumped from the EBI into the CSO control facility at the Elliott West site, flows from the Dexter Station would be diverted from the existing Central Trunk to the new Mercer Street Tunnel, and excess flows from the Denny Local Regulator Station and the area tributary to the existing Lake Union Tunnel at Western Avenue and Denny Way would be diverted to the new Mercer Street Tunnel. When tunnel storage approaches capacity and the EBI has insufficient capacity to accept additional flows, flows would be treated at the CSO control facility and discharged out the Elliott West Outfall.

Only when flows exceed the storage and treatment capacity, excess untreated flows would be discharged from the Elliott West site through the Elliott West Outfall. Treated flows would be disinfected with sodium hypochlorite to reduce the fecal coliform level and the residual chlorine would be removed from the disinfected effluent prior to discharge to receiving waters. In the event of an extraordinary storm occurrence which exceeds the capacity of the Elliott West CSO Control Facility and outfall, the excess flows would exit the system through the Denny Way CSO Outfall Extension and/or the Elliott West Outfall.

When a CSO event is over, the majority of the stored wastewater would flow by gravity into the EBI for conveyance to West Point for treatment. Under certain conditions, the Influent Pump Station would pump the remaining volume of wastewater stored in the tunnel into the EBI. The tunnel would be drained following any storm event large enough to cause a diversion to the new tunnel.

A notable advantage of a CSO control facility located downstream in the South Lake Union/Elliott Bay subbasins is the ability to remove floatables from all discharges. Floatables removal from all discharges is an important requirement in the nine minimum controls listed in the federal CSO policy. The CSO control facility provides treatment of all discharges by removing floatables and provides disinfection and dechlorination during larger events (i.e., a one-year storm or larger). This same

Table 3-3
Estimated Construction Duration For
Alternative 1 - CSO Storage and Treatment (the Preferred Alternative)

South Lake Union Subbasin (* Same facility for both alternatives)

Type of Facility	Element (months of construction for element)	Months of Construction
Outfalls		**1**
	*CSO #125 (1)	
Conveyance		**4**
	*CSO #175 (3) Valley Connection (4) South Lake Union CSO Pipeline (1) Lake Union Tunnel CSO Pipeline (2) Central Trunk CSO Pipeline (1)	
Regulating Structures		**10**
	Central Trunk Diversion Structure (4) Lake Union Tunnel Regulator Station (6)	
CSO Control		**10**
	Elliott West CSO Control Facility *East Tunnel Portal Drop Structure* (10)	

Elliott Bay Subbasin (* Same facility for both alternatives)

Outfalls		**7**
	Elliott West Outfall and Denny Way CSO Outfall Extension (7)	
Conveyance		**8**
	Elliott West Effluent Pipeline (5) Elliott West CSO Pipeline (5)	
Regulating Structures		**8**
	*Denny Way Diversion Structure (4) Elliott Bay Interceptor Control Structure (4)	
CSO Control		**46**
	Elliott West CSO Control Facility *Mercer Street Tunnel* (23) *West Tunnel Portal* (11) *Pump Effluent Channel* (6) *Influent Pump Station* (12) *Chemical Storage & Feed Facilities* (15)	

performance could not be achieved with the tunnel alone. All solids and floatables would be pumped into the EBI for conveyance to West Point for treatment.

If no upstream CSO control features that increase or decrease flow in the EBI are assumed, the proposed Denny/Lake Union Project is expected to reduce the total annual overflow volume and frequency at the Denny Way CSO (Table 3-4). In addition, King County's overflows at the Dexter CSO and Seattle's overflows to east and southeast Lake Union would be controlled to one untreated overflow event per outfall per year, thus controlling them to the level currently specified as the ultimate goal by Ecology.

3.6.2 Alternative 2 - Partial Separation and Storage

This section briefly describes Alternative 2 facilities. Appendix C includes a general description of each type of facility. Appendix D describes general construction methods. Appendix Q provides a detailed description of each facility including figures with proposed facility placement and landscaping. All facility sizes are approximated based on current design.

3.6.2.1 Facilities

Alternative 2, a partial sewer separation option, is illustrated in Figure 3-2 and consists of outfall improvements, conveyance facilities, storage facilities, and pump station. Tables describing each facility by subbasin are included (Tables 3-5 and 3-6). The Elliott West site would also be used under Alternative 2.

The storage tank in south Lake Union would store flows from east, south and west of the lake. This tank would require private property and easement acquisition for a site of 100,000 square feet in the area bordered by Valley Street, Broad Street, Eighth Avenue North, Thomas Street, and Fairview Avenue North. If this alternative was selected, a siting study would be completed to select a site for the storage tank. The partial separation alternative developed for the southern area of Lake Union isolates the majority of stormwater from the combined sewer system by constructing a separate storm drain system and collecting street runoff. This alternative includes construction of a new overflow into Lake Union from the storage tank in the South Lake Union area. This alternative also includes separation of areas to the east of First Avenue North and Sixth Avenue that drain to Elliott Bay. These separation projects would be served by four new outfalls to Elliott Bay, in the general vicinity of Cedar Street, Denny Way, Mercer Street, and Republican Street. Although current regulatory requirements do not include treatment for stormwater, Alternative 2 takes into consideration some Best Management Practices (e.g., compost filters) which are considered necessary to obtain permits.

The pipe layout and sizes for the storm drain systems are based on the topographic drainage boundaries. City of Seattle standards require no flooding during the 25-year design storm and design of the downstream system to allow for all future separated flows in the topographic basin. Analysis of pollutant loading associated with new stormwater loadings to Lake Union suggests that annual loadings of zinc, lead and polyaromatic hydrocarbons to the lake would be increased compared to the existing CSOs.

Table 3-4
Combined Sewer Overflows in the Denny/Lake Union Basin
Comparison of Before and After Project Completion

Baseline (1981-83)

	Average Total Volume (MG/yr)	**Avg. Frequency per Outfall** (times/yr)
Lake Union CSOs	**101**	**4 to 115**
Phase 1 (6 outfalls)[1]	73.2	10 to 115
CSO #125[1]	3.2	30
CSO #175[1]	9.6	115
Dexter Regulator[2]	15	4
Elliott Bay CSOs	**405**	**51**
Denny Regulator[2]	405	51

Projected (Completion of Project)

	Average Total Volume (MG/yr)	**Avg. Frequency per Outfall** (times/yr)
Lake Union CSOs (Alt 1 and 2)		
Phase 1 (4 outfalls)[1]	<0.1	1 or less
CSO #125	0	0
CSO #175	0	1
Dexter Regulator[3]	1.0	1
Lake Union Stormwater Flows (Alt 2)		
South Lake Union Overflow[1]	42	every rainfall
Elliott Bay CSOs (Alt 1 and 2)		
Denny Regulator[3] (Alt 1)	8 untreated 567 treated	1 8 to 20
Denny Regulator[3,4] (Alt 2)	54 untreated 577 treated	1 8 to 20
Elliott Bay Stormwater Flows (Alt 2)		
Elliott Bay Stormwater Outfalls[1]	66	every rainfall

1 Source: Brown and Caldwell and Seattle Engineering Department 1988.
2 Source: Brown and Caldwell/KCM and Associated Firms and KCWPC 1995a.
3 Source: Bergman and Swarner 1997.
4 Source: Swarner 1994 and Merrill 1997.

Alternative 2, South Lake Union Subbasin Facilities (see Table 3-5). The facilities in the South Lake Union Subbasin connect CSOs from Seattle's Phase 1 project in east Lake Union, south Lake Union, and the existing Central Trunk and overflows from the existing Lake Union Tunnel to the new South Lake Union CSO Control Facility for storage before conveyance to the EBI through the existing tunnel and on to West Point for treatment. Most pipelines would be installed using open-cut trenching. Table 3-5 briefly describes the type and name of each facility for Alternative 2 in the South Lake Union Subbasin as well as the approximate size, location and purpose of facilities identified on Figure 3-2. Appendix Q describes each facility in more detail.

Alternative 2, Elliott Bay Subbasin Facilities (see Table 3-6). The facilities in the Elliott Bay Subbasin would convey and store flows from the existing Lake Union Tunnel and the Denny Local wastewater flows to the Denny CSO Control Facility. New stormwater pipes convey stormwater from the subbasin to Elliott Bay. A connection to the EBI also would allow flows from the EBI to be stored at the Elliott West site or flows from the storage tank or tunnel to be pumped into the EBI for conveyance and treatment at West Point. Table 3-6 briefly describes the type and name of each facility for Alternative 2 in the South Lake Union Subbasin as well as the approximate size, location and purpose of facilities identified on Figure 3-2. Appendix Q describes each facility in more detail.

3.6.2.2 Construction

Approximately 24 miles of new stormwater pipes would be constructed in street rights-of-way using open-trench construction (see Section 3.3.1). The South Lake Union CSO Control Facility would be constructed on a block between Valley Street, Broad Street, Eighth Avenue North, Thomas Street and Fairview Avenue North and could require removal of a portion of the existing Lake Union Tunnel. Table 3-7 presents by subbasin the construction durations estimated for Alternative 2.

3.6.2.3 Operation and Performance

As in Alternative 1, the combined sewer system would continue to overflow during storms larger than the once per year design storm. Runoff from roofs and parking lots on private property would continue to discharge to the combined sewer. Combined sewer flows would continue to be transported away from Lake Union for storage and treatment. New stormwater outfalls would likely require Best Management Practices consistent with Ecology's stormwater manual (i.e., compost filters, oil-water separators, sand filters, etc.) to meet water quality standards and sediment management standards for discharge to Lake Union and Elliott Bay.

Combined wastewater from south and east Lake Union would flow into the storage tank in the South Lake Union area; when capacity is available in the EBI, the stored flows would flow into the existing Lake Union Tunnel for conveyance to the EBI and on to West Point for treatment. Dexter CSOs would also be stored in the existing Lake Union Tunnel and conveyed to the EBI when capacity is available. Meanwhile, excess flows from the EBI would be pumped into the storage tank at the Denny CSO Control Facility. Excess flows from the Denny Local Regulator Station and the area tributary to the existing Lake Union Tunnel at Western Avenue and Denny Way would be diverted to the Denny CSO Control Facility.

Table 3-7
Estimated Construction Duration for Alternative 2 - Partial Separation and Storage

South Lake Union Subbasin (* Same facility for both alternatives)

Type of Facility	Element (months of construction for element)	Months of Construction
Outfalls		**4**
	*CSO #125 (1)	
	South Lake Union Overflow (4)	
Conveyance		**30**
	*CSO #175 (3)	
	Phase 1 Connection (7)	
	South Lake Union Stormwater Pipelines (24)	
	Central Trunk Diversion CSO Pipeline (1)	
Regulating Structures		**4**
	Dexter Avenue Diversion Structure (4)	
CSO Control		**46**
	South Lake Union CSO Control Facility	
	Storage Tank (24)	
	Pump Station (12)	

Elliott Bay Subbasin (* Same facility for both alternatives)

Type of Facility	Element (months of construction for element)	Months of Construction
Outfalls		**2**
	Elliott Bay Stormwater Outfalls (2)	
Conveyance		**40**
	Elliott Bay Stormwater Pipelines (35)	
	Elliott Avenue Pipeline (5)	
Regulating Structures		**4**
	*Denny Way Diversion Structure (4)	
CSO Control		**24**
	Denny CSO Control Facility	
	Storage Tank (24)	
	Influent Pump Station (12)	
	Effluent Pump Station (12)	

In the event of an extraordinary storm occurrence that exceeds the capacity of the Denny CSO Control Facility or the South Lake Union CSO Control Facility, the excess flows would exit the system through

the existing Denny Way CSO or the new South Lake Union Overflow, respectively. When a CSO event is over, the majority of the stored wastewater would flow by gravity into the EBI for conveyance to West Point for treatment. Under certain conditions, the remaining volume of wastewater stored in the tunnel and possibly the storage tank would have to be pumped into the EBI by the Influent Pump Station.

If no upstream CSO control features that increase or decrease flow in the EBI are assumed, the proposed Denny/Lake Union Project is expected to control the total annual overflow volumes at the Denny Way CSO and to control overflow frequencies to once per year (see Table 3-4). In addition, King County's overflows at Dexter and Seattle's overflows to east and southeast Lake Union would be controlled to one untreated overflow event per outfall per year, thus controlling them to the level of control currently specified as the ultimate goal by Ecology.

3.6.3 Alternative 3 - No Action Alternative

Under the No Action Alternative (Figure 3-3), no new CSO control facilities would be constructed in the South Lake Union and Elliott Bay subbasins and discharge of CSOs would continue. A street vacation would not be required for Alternative 3.

3.7 COMPARISON OF ALTERNATIVES

This section provides a comparative evaluation of the environmental impacts of the three alternatives to assist decisionmakers (Seattle City Council and King County Council) in making a choice among them. Mitigation measures are identified to reduce impacts. The comparative evaluation addresses those impacts that are most likely to affect the decisionmakers' choice among alternatives. These impacts are associated with the following elements of the environment: Earth, Water, Biological, and Environmental Health. The three alternatives differ highly in their environmental impacts on these elements as well as in the degree to which they meet Ecology's CSO requirements.

The comparative evaluation also briefly addresses those impacts that are less likely to affect the decisionmakers' choices among alternatives. These impacts are associated with the following elements of the environment: Air, Energy, Noise, Land and Shoreline Use, Recreation, Aesthetics, Historical and Cultural Preservation, Transportation, Public Utilities and Services, and Socioeconomics. Environmental impacts and mitigation measures for these elements are similar in nature among Alternatives 1 (CSO Storage and Treatment) and 2 (Partial Separation and Storage), and differ for Alternative 3 because no construction of facilities would occur. All significant adverse impacts to any resource from construction and operation of the project can be mitigated; therefore, there would be no unmitigable significant adverse impacts from the project.

figure 3-3

Storage and treatment (Alternative 1) controls CSOs by holding runoff and storing for later treatment at West Point or treating on site before discharging. This reduces the net discharge of pollutants to local receiving waters. In comparing separation and storage projects, past CSO studies by Seattle and King County (as Metro) indicated that for comparable CSO volume reduction, storage resulted in significantly lower net loadings of pollutants to Lake Union and Elliott Bay receiving waters compared to separation. However, the storage options increase total CSO control costs.

In contrast to storage and treatment, separation projects (Alternative 2), dramatically reduce volume and frequency of CSOs, but do so by discharging a far larger volume of stormwater at greater frequency than the CSO. For example, compared to the existing CSO, stormwater from partial separation might amount to 2 to 3 times greater volume discharged than currently occurs through CSOs. In the existing combined system, much of this stormwater and its associated pollutants are diverted to the treatment plant.

From the overall perspective of Puget Sound, the differences in pollutant loading between storage and separation approaches is minor, particularly when compared to other inputs of pollutants. At the shoreline, where CSO and storm drain discharges occur, and where a majority of beneficial uses take place, however, the differences are important. Alternative 1 would remove all but one overflow per year away from the shoreline. Alternative 2 would continue to discharge stormwater into nearshore areas during most rainfall events.

Differences in pollution loading between either Alternatives 1 or 2 and the No Action Alternative (Alternative 3) are comparatively more significant for Lake Union than Elliott Bay. No project would mean that the King County's Dexter CSO and Seattle's CSO #175 and CSO #125 would continue discharging 15 million gallons per year into Lake Union, discharges from the Phase 1 Connection would continue at greater than one per year, and King County's Denny Way CSO would continue discharging 405 million gallons per year into Elliott Bay. The associated pollutant loadings, contamination, and decrease in water quality would continue in both waterbodies.

3.7.1 Impacts Most Likely to Affect the Decisionmakers' Choice Among Alternatives

Earth. Although Alternative 3 would not have any construction impacts to earth resources, operation impacts of no new facilities would mean the continued contamination of offshore sediments. Alternatives 1 and 2 would require large excavations that could encounter contaminated soils, steep slopes or sensitive soils; however, these impacts are easily mitigable.

Water. Similar to earth impacts, Alternative 3 would allow CSO events to continue at current volumes and frequencies, which would increase levels of contaminants in nearshore environments and suspended in water. Alternatives 1 and 2 would reduce CSO frequencies and volumes that would contribute to long-term water quality improvement in Lake Union and Elliott Bay. Alternative 2 would not be as beneficial to waterbodies as Alternative 1 due to localized pollutant loading from an increase in stormwater discharges and associated contaminants of concern. As for earth resources, Alternatives 1 and 2 would require dewatering in excavations which could cause subsidence, saltwater intrusion, or contact with contaminated groundwater; however, these impacts are also easily mitigable.

Biological. Although construction of Alternatives 1 and 2 would require disturbance and removal of wildlife habitat and vegetation, this impact would be temporary and cleared areas would be restored. No nests of endangered or threatened species are located within the project area, however bald eagles, peregrine falcons, and marbled murrelets are known to occur in the area during feeding or foraging. Since these birds have adjusted to the urban environment, construction could temporarily modify their foraging patterns. The long-term impacts of an increase in water quality in area waterbodies would benefit all wildlife and plants that use or live on the shore in the intertidal areas. Levels of toxic chemicals in fish and shellfish would decrease after reduction of CSOs and related pollutants; thus improving fishing and shellfishing in Elliott Bay and Lake Union. Because of the discharge of stormwater, Alternative 2 would have less beneficial impacts on biological resources than Alternative 1. Alternative 3 would continue increasing levels of CSO contaminants in water and shoreline areas which would continue to affect plants, birds, fish and shellfish.

Environmental Health. Although risks to workers and the public from hazardous material spills or contaminated soils and groundwater would exist during construction of Alternatives 1 and 2, mitigation measures, spill response plans and construction management would greatly reduce the risks to workers and the public. Construction of one outfall through the Denny Way Sediment Cap in Alternative 1 could resuspend contaminated sediments; however curtains could be used to minimize sediment dispersal outside the construction area. By reducing or eliminating CSOs under Alternatives 1 and 2, the environmental health risks from bacterial and viral loadings would be reduced or eliminated. Alternative 3 would continue to discharge CSOs on the beach at Myrtle Edwards Park and into Lake Union, thus risks to human health would continue and could increase in the future.

3.7.2 Impacts Less Likely to Affect the Decisionmakers' Choice Among Alternatives

Air. Construction of Alternatives 1 and 2 would result in fugitive dust, vehicle emissions, and the potential of methane gas release. Alternative 2 would have a greater impact due to more pipeline construction. However, these impacts would be short term. All three alternatives could have odor generation during or after CSO events.

Energy. Alternatives 1 and 2 would use electricity and fossil fuels. Alternative 3 would have no energy impacts.

Noise. Construction of Alternatives 1 and 2 would temporarily increase noise levels in the project area. Alternative 2 would have higher levels in residential areas due to storm sewer pipeline construction. Alternative 3 would have no noise impacts.

Land and Shoreline Use. None of the three alternatives would require changes to land use designations or impacts to sensitive areas; however, right-of-way would be required for some facilities. Construction of outfalls and some regulating facilities would be necessary in the shoreline zone and intertidal areas in Alternatives 1 and 2. Alternatives 1 and 2 remove the CSO #125 outfall pipe from a beach area; Alternative 3 does not.

Recreation. During construction, disturbance and disruption of park areas, bike paths and areas of waterbodies would be affected. However, these would be temporary impacts. Alternative 3 would continue the potential for beach closings after CSO events.

Aesthetics. Minor impacts to visual resources would occur during construction. All aboveground facilities would include architectural treatment and landscaping to reduce impacts to sensitive receptors. The height of the facilities at the Elliott West site would be below the level of the container train cars that are usually stored on the tracks between the project site and the park.

Historical and Cultural Preservation. During construction, Alternative 1 has the potential to affect 7 historic structures from vibration or ground settling and Alternative 2 has the potential to affect 15 properties. Alternative 3 would not affect any properties. Alternatives 1 and 2 would require an professional archaeologist for on-site monitoring in specific areas of the project.

Transportation. Alternative 3 would have no impacts to transportation resources. Alternatives 1 and 2 construction would increase traffic congestion by about one percent and would require street and lane closures, displace street parking, and disrupt access to adjacent properties. Bicycle lanes (e.g., Dexter Avenue North, etc.) would also be disrupted and require detours. All of these impacts are mitigable. Outfall construction could also disrupt marine anchorage and rail traffic. These construction impacts are temporary.

Public Utilities and Services. Although disruption or relocation of facilities could occur during construction of Alternatives 1 and 2, the Seattle and King County wastewater systems in the two subbasins would work more effectively after project completion. Alternative 3 would continue wastewater system overflows and backups in the South Lake Union and Elliott Bay Subbasins.

Socioeconomics. Minor disruption to business patronage could occur during construction, but employment requirements of construction would be beneficial. Minimal impacts would occur from operation of the facilities.

3.7.3 Other Important Information for Decisionmakers

An advantage of Alternative 1 is the system redundancy provided to King County by a new tunnel. The existing Lake Union brick tunnel was found to be in good shape for its age (100 years) in a 1989 study by Brown and Caldwell and Metro. In that study it was recommended that King County continue monitoring the condition of the tunnel and reline it when point repairs would no longer ensure structural integrity. Construction of a new tunnel would facilitate future relining of the brick structure by providing a ready means for diverting flows during the repairs.

As required by Ecology, Alternatives 1 and 2 would achieve the greatest reasonable reduction of CSOs at the earliest possible date. In addition, the schedule for the Denny/Lake Union Project allows for modifications to design if required by the final service strategy selected in King County's Regional Wastewater Sewer Plan.

3.7.4 Estimated Project Costs for Phases 2 and 3/4

Each year, the King County budget process establishes the monetary requirements for the disposal of sewage. These requirements include administration, operating, maintenance repair/replacement, necessary capital reserves, and the requirements of bond resolutions. For 1998 and 1999, the established King County sewer rate is $19.10 per month per residential customer. This rate captures the impact from all King County wastewater capital projects including the Denny/Lake Union Project and ongoing operating expenditures. The Denny/Lake Union Project receives no money from the State Revolving Fund because these funds cannot be used for CSO treatment. Therefore, there are no impacts related to this fund at present.

Additionally, the project has been awarded a $35.0 million Infrastructure Grant by EPA. King County and the City of Seattle share this grant, with $6.5 million reserved for Phases 1 and 2 and $28.5 million reserved for Phase 3/4. The effect of this grant is described below.

Alternative 1 - Storage and Treatment. Table 3-8 summarizes the most probable estimated order-of-magnitude project costs escalated up through the point of award of all of construction contracts (2001). Total estimated project cost including City of Seattle Phase 1 and Phase 2 work is $164.3 million.

The total rate impact for the preferred alternative for 1999 is estimated to be $0.02 of the $19.10 sewer rate, rising to $0.95 - 1.14 of the total rate by project completion in the year 2004. The EPA infrastructure grant of $28.5 million (King County's share of the grant) reduces the rate impact of the Denny/Lake Union Project by $0.07 in 2000 and $0.27 by the year 2004.

Table 3-9 shows the anticipated King County rate impact from Alternative 1 on a year by year basis, both with and without the EPA Infrastructure Grant. This table should not be construed as a user rate forecast; the figures shown only attempt to demonstrate the impact of the Denny/Lake Union Project and the EPA Infrastructure Grant on a year by year basis. The ultimate user rate is comprised of a number of factors, including initiatives such as the Regional Wastewater Services Plan and other projects that may occur many years from now.

Sources of funds for wastewater capital improvement program include:

- Contribution from the operating fund (Customer Charges {sewer rate}, Investment Income, Capacity Charge, City of Seattle CSO Charge, and Other Miscellaneous Revenue {Industrial Surcharge Fees, Septic Tank Disposal Fees, Sale of By-Products, and small amounts of additional miscellaneous contributions})

- Capital Fund Sources (Proceeds From Bond Sales, Short-Term Borrowing, and Other Capital Revenues {non-operating and capital revenues})

Alternative 2 - Partial Separation. Table 3-10 shows the probable estimated order of magnitude project cost for Alternative 2. This alternative was not considered further due to the excessive construction disruption and ultimate project cost. Total project cost including City of Seattle Phases 1 and 2 is $309.3 million escalated up through the point of award of all construction contracts (2001).

Table 3-8
Estimated Project Costs
Alternative 1 - CSO Storage and Treatment (the Preferred Alternative)
(Capital costs in millions of dollars at time of expenditure)

	Phase 1 (Seattle)	**Phase 2** (Seattle)	**Phase 3/4** (King County and Seattle)	**Total Project**
Estimated Construction Cost				
Construction Costs including Contingencies and Sales Tax	$12.8	$4.4	$104.8	**$122.0**
Estimated Non-construction Costs				
Engineering, Administrative and Land/Permit Acquisition Costs	3.2	1.7	37.4	**42.3**
Most Probable Project Cost	**16.0**	**6.1**	**142.2**	**$164.3**
Funding Sources				
King County			94.4	**$94.4**
Federal grant	5.2	1.3	28.5	**35.0**
City of Seattle cost share	10.8	4.8	19.3	**34.9**
Estimated Annual O&M Costs	*$100,000*	*$20,000*	*$501,000*	*$621,000*

Note: Construction cost estimate for Phase 3/4 is based on fourth quarter 1997 dollars (ENR Seattle Construction Cost Index of 6640), escalated to time of construction. The range of accuracy for the Phases 3/4 construction cost estimate is +20% to -15%, thus giving a range of probable construction cost between $89.1 and $125.8 million.

Table 3-9
King County Component Rate Impact
Preferred Alternative - CSO Storage and Treatment (the Preferred Alternative)

	1999	**2000**	**2001**	**2002**	**2003**	**2004**
Component Rate Impact without EPA Infrastructure Grant	$0.02	$0.18-.22	$0.43-.52	$0.67-.80	$0.88-1.06	$0.95-1.14
Component Rate Impact of EPA Infrastructure Grant	$0.00	$0.07	$0.17	$0.26	$0.27	$0.27
Net Rate Impact with EPA Infrastructure Grant	$0.02	$0.11-.15	$0.26-.35	$0.41-.54	$0.61-.79	$0.68-.87

Note: Range of rate impacts shows 1) rate with estimated Phase 3/4 construction cost as shown in Table ES-2 ($104.8 million) and 2) rate with construction cost at high end of range of probable construction costs ($125.8 million).

Table 3-10
Estimated Project Costs
Alternative 2 – Partial Separation and Storage
(Capital costs in millions of dollars at time of expenditure)

	Phase 1 (Seattle)	**Phase 2** (Seattle)	**Phase 3/4** (King County and Seattle)	**Total Project**
Estimated Construction Cost				
Construction Costs including Contingencies and Sales Tax	$12.8	$6.2	$220.9	**$239.9**
Estimated Non-construction Costs				
Engineering, Administrative and Land/Permit Acquisition Costs	3.2	1.8	64.4	**69.4**
Most Probable Project Cost	**16.0**	**8.0**	**285.3**	**$309.3**
Funding Sources				
King County			213.1	**$213.1**
Federal grant	5.2	1.3	28.5	**35.0**
City of Seattle cost share	10.8	6.7	43.7	**61.2**
Estimated Annual O&M Costs	*$100,000*	*$20,000*	*$1,300,000*	*$1,400,000*

Note: Construction cost estimate for Phase 3/4 is based on fourth quarter 1997 dollars (ENR Seattle Construction Cost Index of 6640), escalated to time of construction. The range of accuracy for the Phases 3/4 construction cost estimate is +20% to -15%, thus giving a range of probable construction cost between $89.1 and $125.8 million.

Table 3-11
King County Component Rate Impact
Alternative 2 – Partial Separation and Storage

	1999	**2000**	**2001**	**2002**	**2003**	**2004**
Component Rate Impact without EPA Infrastructure Grant	$0.02	$0.41	$0.96	$1.48	$1.96	$2.07
Component Rate Impact of EPA Infrastructure Grant	$0.00	$0.07	$0.17	$0.26	$0.27	$0.27
Net Rate Impact with EPA Infrastructure Grant	$0.02	$0.34	$0.79	$1.22	$1.69	$1.80

Note: Range of rate impacts shows 1) rate with estimated Phase 3/4 construction cost as shown in Table ES-2 ($104.8 million) and 2) rate with construction cost at high end of range of probable construction costs ($125.8 million).

The total rate impact for Alternative 2 for 1999 is estimated to be $0.02 of the $19.10 sewer rate, rising to $2.07 of the total rate by project completion in the year 2004. The EPA infrastructure grant of $28.5 million (King County's share of the grant) reduces the rate impact of the Denny Way project by $0.27 by the year 2004.

Table 3-11 in shows the anticipated King County rate impact from Alternative 2 on a year by year basis, both with and without the EPA infrastructure grant.

Alternative 3 - No Action. No capital costs would be required for Alternative 3, however, Ecology and EPA would assess penalties against King County and Seattle for non-compliance with water quality regulations.